PATENT
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

John Stephen Smith

Application No.: To be assigned

Filed: June 8, 2001

For: METHOD AND APPARATUS FOR FABRICATING SELF-ASSEMBLING MICROSTRUCTURES

Art Unit: To be assigned

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination of the above-referenced application, please enter the following amendments and remarks.

IN THE SPECIFICATION:

Please replace the paragraph beginning on page 1, line 4 with the following rewritten paragraph:

--This application is a continuation of U.S. Application Serial No. 09/097,599, filed June 15, 1998, which is a continuation of U.S. Application Serial No. 08/480,500, filed June 7, 1995, now U.S. Patent No. 5,904,545, which is a continuation-in-part of U.S. Application Serial No. 08/169,298, filed December 7, 1993, now U.S. Patent No. 5,545,291, the disclosure of which is hereby incorporated in its entirety for all purposes.

This application is related to U.S. Application Serial No. 08/485,478, filed June 7, 1995, now U.S. Patent No. 5,824,186, which is a continuation-in-part of U.S. Application Serial No. 08/169,298, filed December 7, 1993, now U.S. Patent No. 5,545,291, the disclosure of which is hereby incorporated in its entirety for all purposes.

This application is also related to U.S. Application Serial No. 08/437,540, filed May 9, 1995, now U.S. Patent No. 5,783,856, which is a divisional of U.S. Application Serial No.

08/169,298, filed December 7, 1993, now U.S. Patent No. 5,545,291, the disclosure of which is hereby incorporated in its entirety for all purposes.--

IN THE CLAIMS:

Please cancel claims 46-51 and add new claims 52-165 as follows:

52. A structure comprising an assemblage of separate functional blocks, each functional block having a first surface and a second surface substantially parallel to said first surface, said functional block further having side surfaces connecting said first surface to said second surface, said first surface having a smaller area than said second surface.

53. The structure of claim 52 wherein said functional block has a maximum linear dimension of about 50 microns or less.

54. The structure of claim 52 wherein said functional block has a trapezoidal cross-section.

55. The structure of claim 52 wherein said side surfaces are etched surfaces.

56. The structure of claim 52 wherein said functional block is a multilayered structure.

57. The structure of claim 56 wherein said multilayered structure includes a metal layer.

58. The structure of claim 56 wherein said multilayered structure includes an insulator layer.

59. The structure of claim 56 wherein said multilayered structure includes a layer of silicon dioxide.

60. The structure of claim 56 wherein said multilayered structure includes a layer of silicon nitride.

61. The structure of claim 52 wherein said functional block comprises material is selected from the group consisting of silicon, gallium arsenide, aluminum gallium arsenide, diamond, and germanium.

62. The structure of claim 52 wherein said functional block comprises a group III-V compound.

63. The structure of claim 52 wherein said functional block comprises a group II-VI compound.

64. The structure of claim 52 wherein the perimeter of said first surface has a rectangular shape, an octagonal shape, or a circular shape.

65. A functional block comprising semiconductor material and having a profile of a shape generally that of a truncated pyramid, said functional block having a maximum linear dimension of about 50 microns or less, said functional block being separated from a substrate.

66. The functional block of claim 65 further having a first surface and a second surface substantially parallel to said first surface.

67. The functional block of claim 66 wherein the perimeter of said first surface has a rectangular shape, an octagonal shape, or a circular shape.

68. The functional block of claim 65 wherein said semiconductor material is a multilayered structure.

69. The functional block of claim 65 wherein said semiconductor material is a group III-V compound.

70. The functional block of claim 69 wherein said semiconductor material is gallium arsenide.

71. The functional block of claim 65 wherein said semiconductor material is a light-emitting diode.

72. The functional block of claim 71 wherein said semiconductor material is a gallium arsenide light-emitting diode.

73. The functional block of claim 65 wherein said semiconductor material is a laser diode.

74. The functional block of claim 65 having one of a cylindrical shape, a rectangular shape, a square shape, a hexagonal shape, a pyramid shape, a T-shape, and a kidney shape.

75. A shaped block of material adapted for being received in a recess of a substrate, said shaped block of material comprising a solid having sloped sides and a top surface connected to a bottom surface by said sloped sides, said top surface being substantially parallel to said bottom surface, said top surface being non-congruent with said bottom surface.

76. The shaped block of claim 75 wherein said block of material has a maximum linear dimension of about 50 microns or less.

77. The shaped block of claim 75 wherein said sloped sides are etched sides.

78. The shaped block of claim 75 wherein said sloped sides have a slope greater than about twenty degrees relative to a line normal to said top surface.

79. The shaped block of claim 75 wherein said material comprises a multilayered structure.

80. The shaped block of claim 75 wherein said material is selected from the group consisting of silicon, gallium arsenide, aluminum gallium arsenide, diamond, and germanium.

81. The shaped block of claim 75 wherein said material is a group III - V compound.

82. The shaped block of claim 75 wherein said material is a group II - VI compound.

83. The shaped block of claim 75 being an optical detector.

84. The shaped block of claim 75 wherein the perimeter of said first surface has a rectangular shape, an octagonal shape, or a circular shape.

85. A functional block comprising a semiconductor material and having a shape adapted for self-alignment within a shaped opening through a substrate surface, said block having a first surface and a second surface and having etched sides which are sloped such that said block fits into said shaped opening only in an orientation where said first surface is exposed through said substrate surface.

86. The functional block of claim 85 wherein said first surface includes a conductive contact disposed thereon.

87. The functional block of claim 85 wherein said first surface has an area smaller than said second surface.

88. The functional block of claim 87 wherein said first surface has a circular perimeter, a rectilinear perimeter, or an octagonal perimeter.

89. The functional block of claim 85 having a maximum linear dimension of about 50 microns or less.

90. The functional block of claim 85 further comprising a multilayered structure.

91. The functional block of claim 90 wherein said multilayered structure includes a metal layer.

92. The functional block of claim 90 wherein said multilayered structure includes an insulator layer.

93. The functional block of claim 90 wherein said multilayered structure includes a layer of silicon dioxide.

94. The functional block of claim 90 wherein said multilayered structure includes a layer of silicon nitride.

95. The functional block of claim 85 being a light-emitting diode.

96. The functional block of claim 85 being a laser diode.

97. The functional block of claim 85 being an optical detector.

98. A semiconductor microstructure comprising a wedge-shaped block having a first surface substantially parallel to a second surface, said first surface having an associated first area, said second surface having an associated second area, said first area being larger than said second area, said block having a maximum linear dimension of about 50 microns or less.

99. The semiconductor microstructure of claim 98 wherein said wedge-shaped block comprises material selected from the group consisting of silicon, gallium arsenide, aluminum gallium arsenide, diamond, and germanium.

100. The semiconductor microstructure of claim 98 wherein said wedge-shaped block comprises a group III-V compound.

101. The semiconductor microstructure of claim 98 wherein said wedge-shaped block comprises a group II-VI compound.

102. The semiconductor microstructure of claim 98 wherein said wedge-shaped block is a multilayered structure.

103. The semiconductor microstructure of claim 102 wherein said multilayered structure constitutes a light-emitting diode.

104. The semiconductor microstructure of claim 103 wherein said multilayered structure includes gallium arsenide.

105. A portion of an integrated circuit device comprising a functional block separated from a substrate, said functional block comprising a semiconductor material and having a maximum linear dimension of about 101 microns or less, said functional block having a wedge-shaped profile, said functional block having etched sides.

106. The portion of an integrated circuit device of claim 105 wherein said semiconductor material is a multilayered structure.

107. The portion of an integrated circuit device of claim 105 wherein said semiconductor material is selected from the group consisting of silicon, gallium arsenide, aluminum gallium arsenide, diamond, and germanium.

108. The portion of an integrated circuit device of claim 105 wherein said semiconductor material is a group III-V compound.

109. The portion of an integrated circuit device of claim 105 wherein said semiconductor material is a group II-VI compound.

110. The portion of an integrated circuit device of claim 105 wherein said semiconductor material constitutes a light-emitting diode.

111. The portion of an integrated circuit device of claim 110 wherein said light-emitting diode is a gallium arsenide light-emitting diode.

112. An electronic chip comprising a block of material separated from a substrate and having a first surface and a second surface substantially parallel to said first surface, said block further having etched side surfaces extending from said first surface to said second surface, said first surface having an areal measurement different than an areal

measurement of said second surface, said first surface having a conductive contact disposed thereon.

113. The electronic chip of claim 112 wherein said block of material has a width of about 50 microns or less and a length of about 50 microns or less.

114. The electronic chip of claim 112 wherein said etched side surfaces have a slope relative to a line normal to said first surface of greater than about twenty degrees.

115. The electronic chip of claim 112 wherein said material comprises a multilayered structure including one or more layers of semiconductor material.

116. The electronic chip of claim 115 wherein said multilayered structure includes a silicon layer and a gallium arsenide layer.

117. The electronic chip of claim 115 wherein said multilayered structure includes a p-type gallium arsenide layer, an n-type gallium arsenide layer, and a eutectic layer.

118. The electronic chip of claim 117 wherein said multilayered structure further includes a silicon substrate layer.

119. The electronic chip of claim 112 wherein said material is semiconductor material.

120. The electronic chip of claim 112 wherein said electronic chip is a light-emitting diode.

121. The electronic chip of claim 112 wherein said electronic chip is a gallium arsenide resonant tunneling diode.

122. The electronic chip of claim 112 wherein said electronic chip is a gallium arsenide diode.

123. The electronic chip of claim 112 wherein said electronic chip is a gallium arsenide microwave device.

124. The electronic chip of claim 112 having one of a cylindrical shape, a rectangular shape, a square shape, a hexagonal shape, a pyramid shape, a T-shape, and a kidney shape.

125. An electronic chip comprising a functional block including a semiconductor material, said functional block having a wedge shape with a top surface and a bottom surface smaller than said top surface, said functional block further having a maximum linear dimension of about 50 microns or less, the perimeter of said top surface having a rectilinear shape, a circular shape, or an octagonal shape.

126. The electronic chip of claim 125 wherein said top surface is substantially parallel to said bottom surface.

127. The electronic chip of claim 125 further including a conductive contact disposed atop said top surface.

128. The electronic chip of claim 125 wherein said semiconductor material is a multilayered structure.

129. The electronic chip of claim 128 wherein said multilayered structure constitutes a light-emitting diode.

130. An electronic component separated from a first substrate comprising:
a first surface;
a conductive contact disposed atop said first surface;
a second surface in substantially parallel relation to said first surface; and
etched surfaces connecting said first surface to said second surface,
said etched surfaces being in non-parallel relation to one another,
wherein said electronic component is adapted for self-alignment within a shaped opening through a surface of a second substrate.

131. The electronic component of claim 130 wherein said amount of semiconductor material has a maximum linear dimension of about 50 microns or less.

132. The electronic component of claim 130 wherein said etched surfaces are formed by a wet etch process.

133. The electronic component of claim 130 wherein said etched surfaces are formed by a mask edge.

134. The electronic component of claim 130 wherein said etched surfaces are formed by a reactive ion etch process.

135. The electronic component of claim 130 wherein said etched surfaces are formed by an ion milling process.

136. The electronic component of claim 130 being a light-emitting diode.

137. A light-emitting diode (LED) comprising a semiconductor block having tapered sides, said semiconductor block comprising a first surface and a second surface in substantially parallel relation to said first surface.

138. The LED of claim 137 wherein said semiconductor block has a maximum linear dimension of about 50 microns or less.

139. The LED of claim 137 wherein said tapered sides are etched sides.

140. The LED of claim 137 incorporated in an active display.

141. The LED of claim 137 wherein said semiconductor block is a multilayered structure.

142. The LED of claim 141 wherein said multilayered structure includes gallium arsenide.

143. The LED of claim 141 wherein said multilayered structure includes a group III-V compound.

144. A light-emitting diode (LED) comprising an amount of semiconductor material, said semiconductor material having a first surface and a second surface smaller than said first surface, said semiconductor material having non-parallel side surfaces connecting said first surface to said second surface, said LED having a maximum linear dimension of about 50 microns or less.

145. The LED of claim 144 wherein said first surface is in substantially parallel relation to said second surface.

146. The LED of claim 144 wherein said semiconductor material includes a group III-V compound.

147. The LED of claim 146 wherein said semiconductor material includes gallium arsenide.

148. The LED of claim 144 wherein the perimeter of said first surface has a rectangular shape, an octagonal shape, or a circular shape.

149. A light-emitting diode (LED) comprising a block of semiconductor material including gallium arsenide, said block having a top surface and a bottom surface connected to said top surface by sloped surfaces, said block having a maximum linear dimension of about 50 microns or less.

150. The LED of claim 149 wherein said sloped surfaces are etched surfaces.

151. The LED of claim 150 wherein said etched surfaces are formed by a wet etch process.

152. The LED of claim 150 wherein said etched surfaces are formed by a mask edge.

153. The LED of claim 150 wherein said etched surfaces are formed by a reactive ion etch process.

154. The LED of claim 150 wherein said etched surfaces are formed by an ion milling process.

155. The LED of claim 149 wherein the perimeter of said top surface has a rectangular shape, an octagonal shape, or a circular shape.

156. A laser diode comprising a wedge-shaped block of semiconductor material having a maximum linear dimension of about 50 microns or less.

157. The laser diode of claim 156 wherein said semiconductor material comprises a group III-V compound.

158. The laser diode of claim 157 wherein said semiconductor material comprises gallium arsenide.

159. The laser diode of claim 156 wherein said block comprises first and second surfaces in parallel relation and etched side surfaces connecting said first and second surfaces, said first surface having an area different than an area of said second surface.

160. The laser diode of claim 156 incorporated in an optical data channel.

161. An optical detector comprising a wedge-shaped block of semiconductor material having a maximum linear dimension of about 50 microns or less.

162. The optical detector of claim 161 wherein said semiconductor material comprises a group III-V compound.

163. The optical detector of claim 162 wherein said semiconductor material comprises gallium arsenide.

164. The optical detector of claim 161 wherein said block comprises first and second surfaces in parallel relation and etched side surfaces connecting said first and

second surfaces, said first surface having an area different than an area of said second surface.

165. The optical detector of claim 161 incorporated in an optical data channel.

REMARKS

Status of the Application

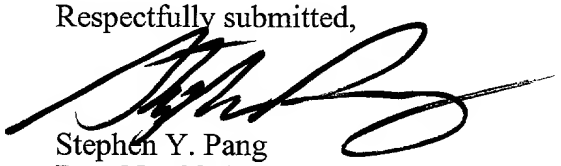
Claims 52-165 have been added without the introduction of new matter.

CONCLUSION

In view of the foregoing, Applicant believes all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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